

# Informational Leaflet 156

## FORECAST OF THE 1972 KODIAK AREA PINK SALMON RUN

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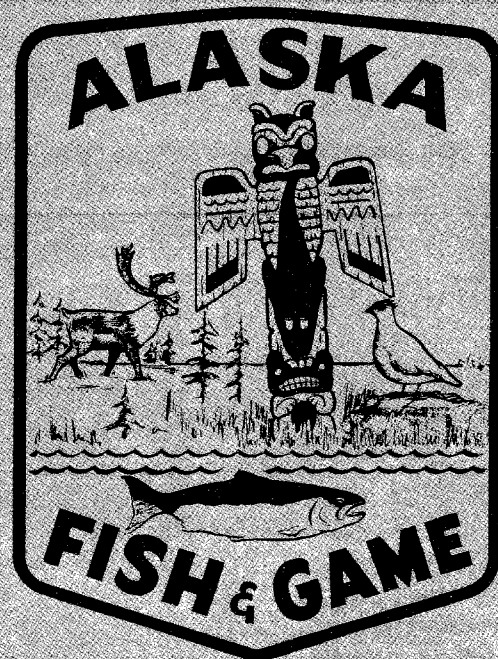
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By

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## INTRODUCTION

Pink salmon (Oncorhynchus gorbuscha) are a commercially valuable and renewable resource in the Kodiak Area. This report constitutes the seventh annual Kodiak Area forecast publication on this species of Pacific salmon. A forecast that is sufficiently accurate for use by fishery management personnel and the fishing industry is invaluable. The main objective of this study is to forecast the 1972 pink salmon run well in advance of the actual return. This should allow fishermen and processors ample time to gear operations for a relatively efficient harvest and give fishery management personnel time to formulate management policy.

Eight years of pre-emergent fry data have been collected for the Kodiak Area (excluding the Mainland district). This report presents the 1972 pink salmon return based on pre-emergent fry abundance. Pink salmon pre-emergent fry sampling in the Kodiak Area is conducted in March and April, after the eggs and fry have experienced most of the over-winter mortality due to erosion, desiccation, freezing, asphyxiation, etc. Pre-emergent fry sampling conducted in the spring after major freshwater mortality factors have occurred is currently the best method of forecasting the abundance of pink salmon.

## METHODS

### Sampling Equipment and Procedures

The technique of sampling pre-emergent fry is similar in all areas of the State and basically the same equipment is used. There are some differences in gear that have evolved, usually for the sake of convenience in transporting the equipment. Most of these changes involve the use of lighter, more compact equipment.

Thirty-one of the more than 200 salmon streams on the Kodiak-Afognak Island complex were chosen as index streams for pre-emergent fry sampling in the spring of 1971. These 31 index streams contained 75 per cent of the estimated total 1970 escapement in the Kodiak Area (excluding the Mainland district).

The area sampled within each of these index streams is the area where (according to aerial surveys) pink salmon spawned in substantial numbers and are areas in the streams that are utilized by spawners each cycle year.

Sampling is begun as soon as ice conditions permit access to the spawning area. The selected spawning streams are reached primarily by chartered helicopter. The helicopter can usually place a sampling unit of three men and lightweight equipment within yards of the study area.

A small Homelite pump with a 4,200 gph capacity, mounted on a specially constructed aluminum stretcher, is placed securely in the middle of each spawning riffle to be sampled. A four-foot water intake hose with a fine screened filter is attached to the pump. Another one-inch diameter rubber-lined fire hose, 50 feet long, connects the pump to a three-foot-long stainless steel probe with a plastic venturi air intake.

Ten samples are taken within the 50-foot radius of the fire hose, making the total length of the sampling site 100 feet. Both sides of the creek are sampled about every 15-25 feet and five samples are taken on each side of the center of the stream.

Water is pumped through the hose, venturi, probe, and into the stream bed. One crewman "works" the steel probe as deep as possible into the gravel within the confines of a circular collection frame which encloses two square feet of stream bed. One-eighth inch stainless steel screening covers the upstream half of the frame. The downstream half of the collection frame opens into a five-foot-long fine-meshed, tapered nylon net. The water and air mixture forced into the spawning gravel bubbles up the eggs, fry, detritus and gravel which is carried downstream into the tapered net. The heavier gravels settle out in the upstream portion of the net and the eggs, fry, and all other light materials are swept to the cod end. A binder clip at the cod end is released and the eggs, fry and lighter materials are emptied into a collecting pan. The live fry are then carefully counted and the dead eggs and fry noted. After the tenth sample has been completed in the 100-foot-long sampling area, the equipment is carried downstream to the next sampling location.

Forty to 180 samples are taken in each index stream depending on the length of the spawning area. Usually the sampling area covers a substantial portion of the major spawning area in each stream. On very large streams where salmon spawn for several miles, it would be difficult and time-consuming to sample small areas along the entire length of the spawning area to be sure that survival in the sampled area was representative. In streams where spawning occurs over a large area and different survival rates are suspected, an upstream and downstream location or a right and left fork, etc., are sampled.

## Forecast Methods

Pre-emergent fry sampling results in an estimated average number of fry per unit area for each index stream and for all index streams combined. These data can then be compared with pink salmon fry data from past years from which the total subsequent adult returns are known. The total adult return is the sum of peak escapement counts from aerial surveys on 37 escapement index streams, plus the commercial catch (Appendix A).

Escapement counts for 1971 have been reported from Alaska Department of Fish and Game observations as well as Fisheries Research Institute observations made by a standard observer (Appendix B).

All years of pink salmon pre-emergent fry data for all streams sampled have been used for the 1972 pink salmon forecast. The number of streams sampled each year has varied from 18 to 31 and only 12 streams have been sampled every year (Table 1). Because of the small number of streams sampled every year, the same stream base has not been used for this forecast. An attempt is being made to derive a fixed set of index streams to be used in developing future salmon forecasts.

The 1972 forecast has been developed using all years of pre-emergent fry-adult return data available. A regression analysis of the data is then used to fit a line to the fry-adult return data. The 1972 pink salmon return is forecast from the 1971 pre-emergent fry index plotted on the fitted line. Confidence limits of 80 per cent have been determined and these limits comprise the range of the forecast.

Pink salmon estimates for certain fishing districts have also been determined using a linear regression on all years of data. District forecasts are often more difficult to determine because it is usually assumed that the catch for any given district is made up primarily of salmon destined to spawn in that district. Of course, tagging experiments have shown that often this is not the case. Actually, many salmon destined for a particular district may be caught by the fishing fleet in neighboring districts. Furthermore, these types of catches are variable from year to year depending on the weather, regulations, size and mobility of the fleet, migration routes of the run and other factors.

## RESULTS AND DISCUSSION

### Kodiak Area Forecast

Thirty-one streams were scheduled for sampling in the spring of 1971, but three streams were not sampled prior to out-migration of the pink salmon fry. Pre-emergent fry sampling of Brown's Lagoon, Malina and Marka Rivers was severely hampered by ice conditions that persisted well into May (Appendix C). Therefore, all data derived from these three streams has been deleted from the regression used in developing the 1972 forecast (Table 2).

Table 1. Pre-emergent fry indices for all streams sampled and subsequent returns, 1963-71.

	Year of Pre-emergent Sampling/Year of Subsequent Adult Return							
	1963/64	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72
No. streams sampled	19	20	18	30	21	31	23	28
Fry density/0.1m <sup>2</sup> all streams	17.80	15.98	5.95	15.31	19.85	29.23	12.64	16.59
Return equal to subsequent catch plus indexed escapement (millions)	13.34	11.48	0.68	9.61	13.20	14.11	4.65	

Table 2. 1971 Kodiak Area Pre-emergent Fry Sampling Results.

Stream	No. 2 ft <sup>2</sup> Samples	No. Fry	Density/0.1m <sup>2</sup> <sup>1/</sup>
Portage Lake (Upstream)	30	652	11.69
Portage Lake (Downstream)	50	2,195	23.62
Paramanof Creek - 304	50	679	7.31
Malina River <sup>2/</sup>	--	--	--
Afognak River	70	255	1.96
Marka Creek <sup>2/</sup>	--	--	--
Danger River	26	481	9.95
Sharatin (Elbow) Creek	50	1,159	12.47
Bauman's Creek	40	215	2.88
Terror River	80	384	2.58
Uganik River	80	1,078	7.25
Little River	100	4,696	25.26
Zachar River	60	586	5.25
Brown's Lagoon <sup>2/</sup>	50	15	.16
Uyak River	70	1,368	10.51
Karluk River	100	533	2.87
Sturgeon River	110	353	1.73
Red River	140	2,994	11.50
Dog Salmon River (Downstream)	70	43	.33
Narrows Creek	50	2,142	23.05
Deadman River	80	10,103	67.94
Humpy River (Upstream) <sup>2/</sup>	--	--	--
Humpy River (Downstream)	60	2,104	18.87
Seven Rivers (Upper Fork)	60	4,268	38.27
Seven Rivers (Lower Fork)	70	9,440	72.55
Kaiugnak Creek	50	1,225	13.18
Barling River	50	1,117	12.02
Kiliuda River - 207	50	497	5.35
Saltery River	90	55	.33
Miam Creek	70	1,053	8.09
Hurst Creek	60	1,677	15.03
Sid Old's River	80	2,358	15.86
American River	90	5,036	30.10
Buskin River	80	5,974	40.18
Totals	2,116	63,735	
Density/0.1m <sup>2</sup> <sup>3/</sup>			16.59

<sup>1/</sup> Density computed in tenth square meters for comparative purposes with other areas.

<sup>2/</sup> Fry began out-migrating before stream could be sampled. Any data obtained is not reliable and has been omitted from all calculations.

<sup>3/</sup> Density is computed from totals and is not an average of all densities listed.

Using all available years of pre-emergent fry data, a line is fitted to the pre-emergent fry index-adult return data (Figure 1). The 1972 return calculated from the equation  $Y = .6157X - .6941$  is estimated to be 9.5 million pink salmon. A correlation coefficient of .86 is associated with this regression estimate. Confidence limits of 80 per cent produce a range for the 1972 forecast of 7.9 - 11.1 million pink salmon.

A projected return for the Kodiak Area may be much more meaningful to the fishery manager and fishing industry if areas of expected strengths or weakness can be revealed. This is often a difficult task because district forecasts cannot compensate for changes between years in rates of interception by the fleet in various fishing districts. However, data from a few districts show a satisfactory correlation to linear regressions made on pre-emergent fry index-adult return data (Figure 2).

The General district extends from Kizhuyak Bay to Cape Trinity on the eastside of Kodiak Island. Using all available years of pre-emergent fry data, the 1972 return calculated from the equation  $Y = .1432X + 1.3183$  is estimated to be 4.58 million pink salmon (Figure 3). A rather poor correlation coefficient of .40 is associated with this regression estimate. The General district should constitute the bulk of the fishery with rivers in Chiniak Bay and Seven Rivers producing strong returns.

In the Alitak district, fry densities were fair to good except for a critical reduction in the Dog Salmon River. A 1972 return calculated from the equation  $Y = .044X + .6082$  is estimated to be 1.92 million pink salmon (Figure 4). A correlation coefficient of .48 is associated with this regression estimate. A record high density in Deadman River should make Deadman Bay the primary producer in this district.

As a matter of interest, a forecast combining the General district and Alitak district has been included because of the high correlation associated with the pre-emergent fry-adult return data. An estimated return of 6.3 million pink salmon has been determined from a regression analysis using data from both the Alitak and General districts. The 1967-69 fry density-return data has been designated as an outlier for the purposes of this calculation. By omitting the 67-69 data, an excellent correlation coefficient of .98 is associated with this regression (Figure 5).

The 1969 return to the south and eastside of Kodiak Island was much larger than anticipated and the reason for this is unknown. One theory is that the previous winter was very mild causing excellent fry survival in many ordinarily insignificant pink salmon producing streams. The sampling densities obtained from the larger index streams may not have compensated for the excellent survival in the more than 100 very small pink salmon streams on the east and southside of Kodiak Island. Consequently in 1969, many of the smaller creeks that usually produced a few hundred or less pink salmon, were producing several thousand. The overall effect of these small creeks was not compensated by the fry densities obtained from the larger streams with the result that the total return for the General and Alitak districts in 1969 was much higher than expected. Whatever the reason, the 1967-69 data does not seem to fit the remaining fry density-adult return figures and therefore was omitted from this regression estimate.

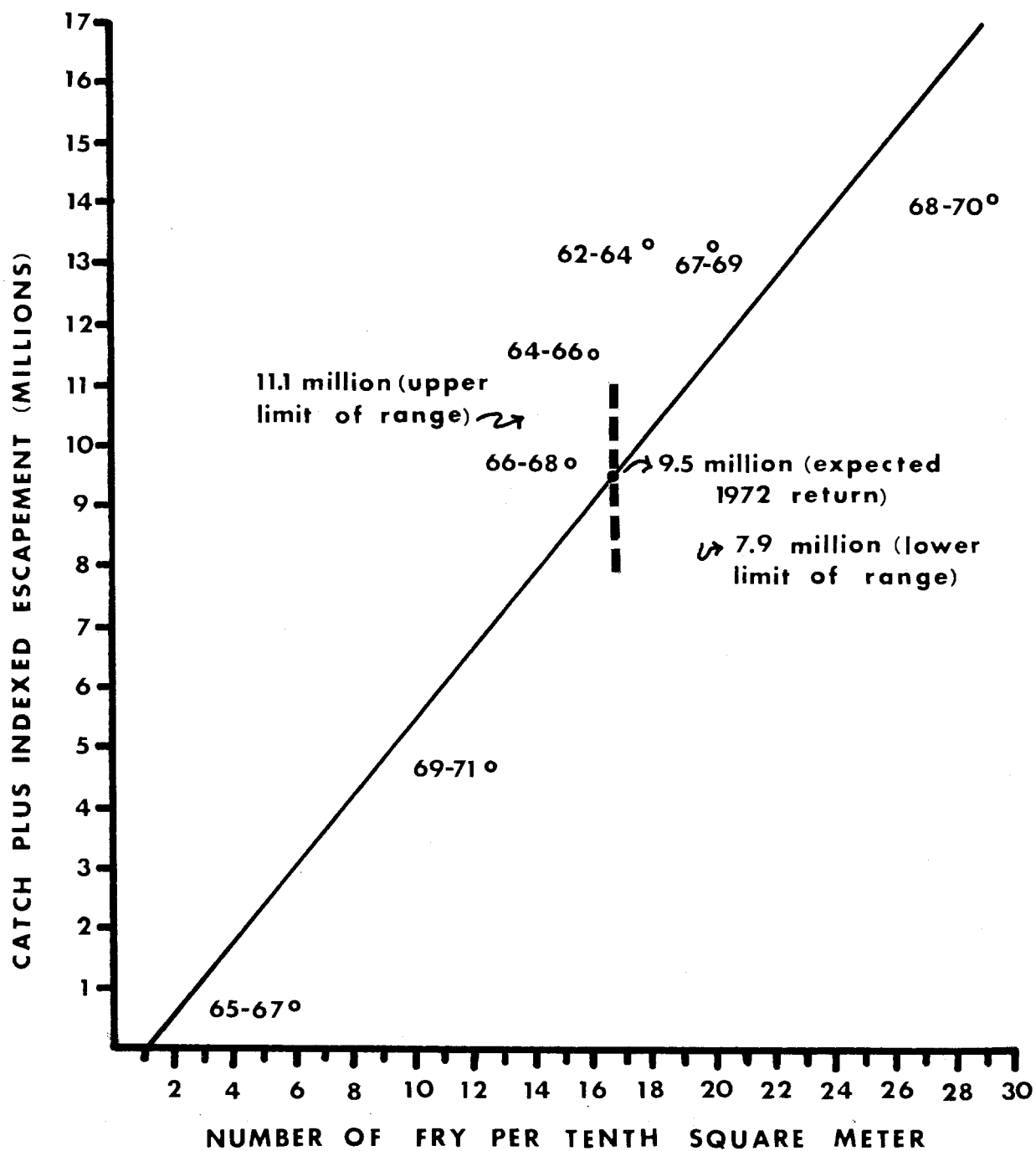


FIGURE 1.--RELATIONSHIP BETWEEN PARENT YEAR FRY DENSITIES 1962-1970 AND SUBSEQUENT ADULT RETURNS 1964-1972, IN THE KODIAK AREA. THE 1963 FRY DENSITY DATA FOR THE 1965 ADULT RETURN IS NOT AVAILABLE.

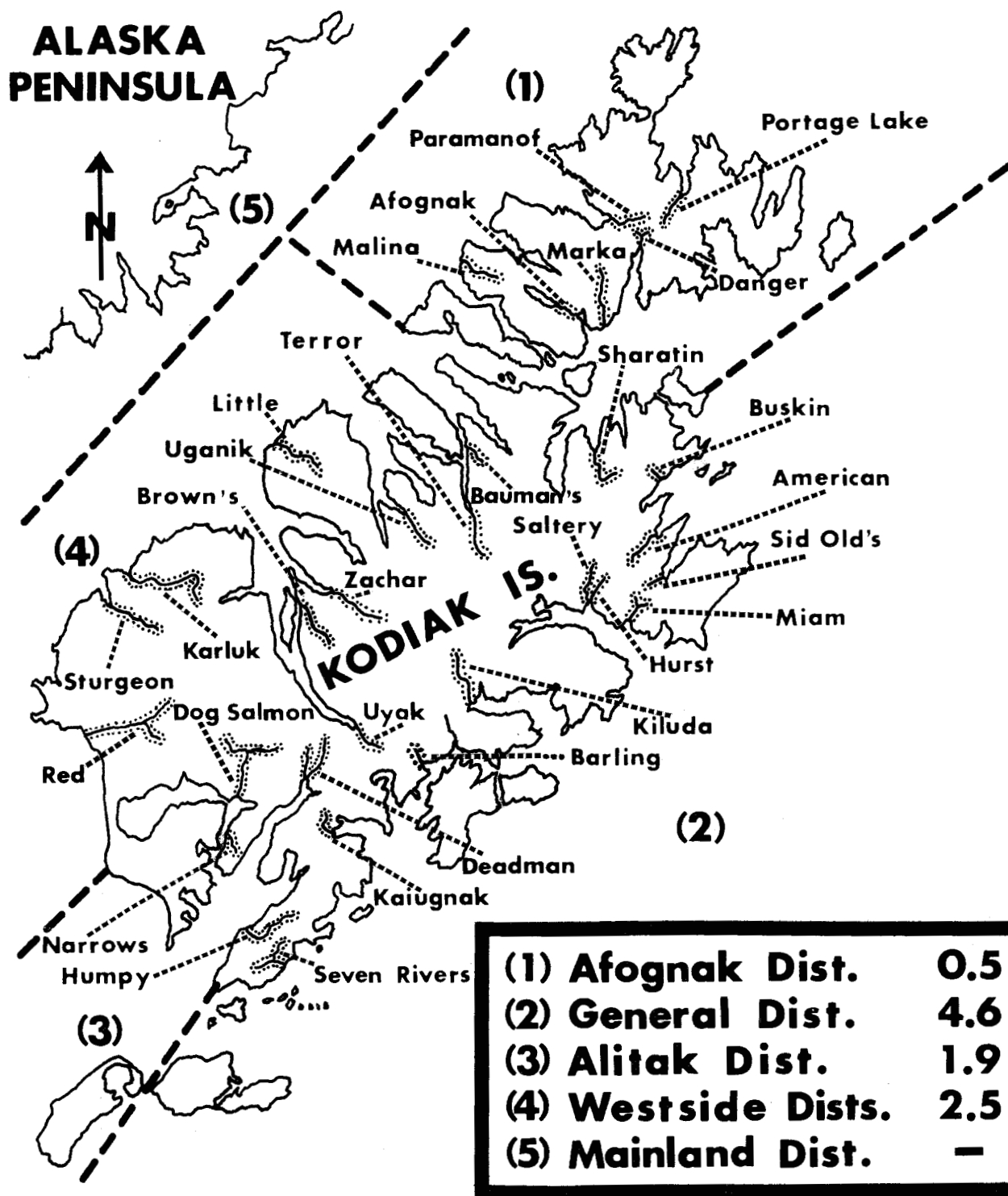


FIGURE 2.--KODIAK AREA PRE-EMERGENT FRY SAMPLING STREAMS AND EXPECTED 1972 RETURN BY DISTRICT (MILLIONS OF PINK SALMON).

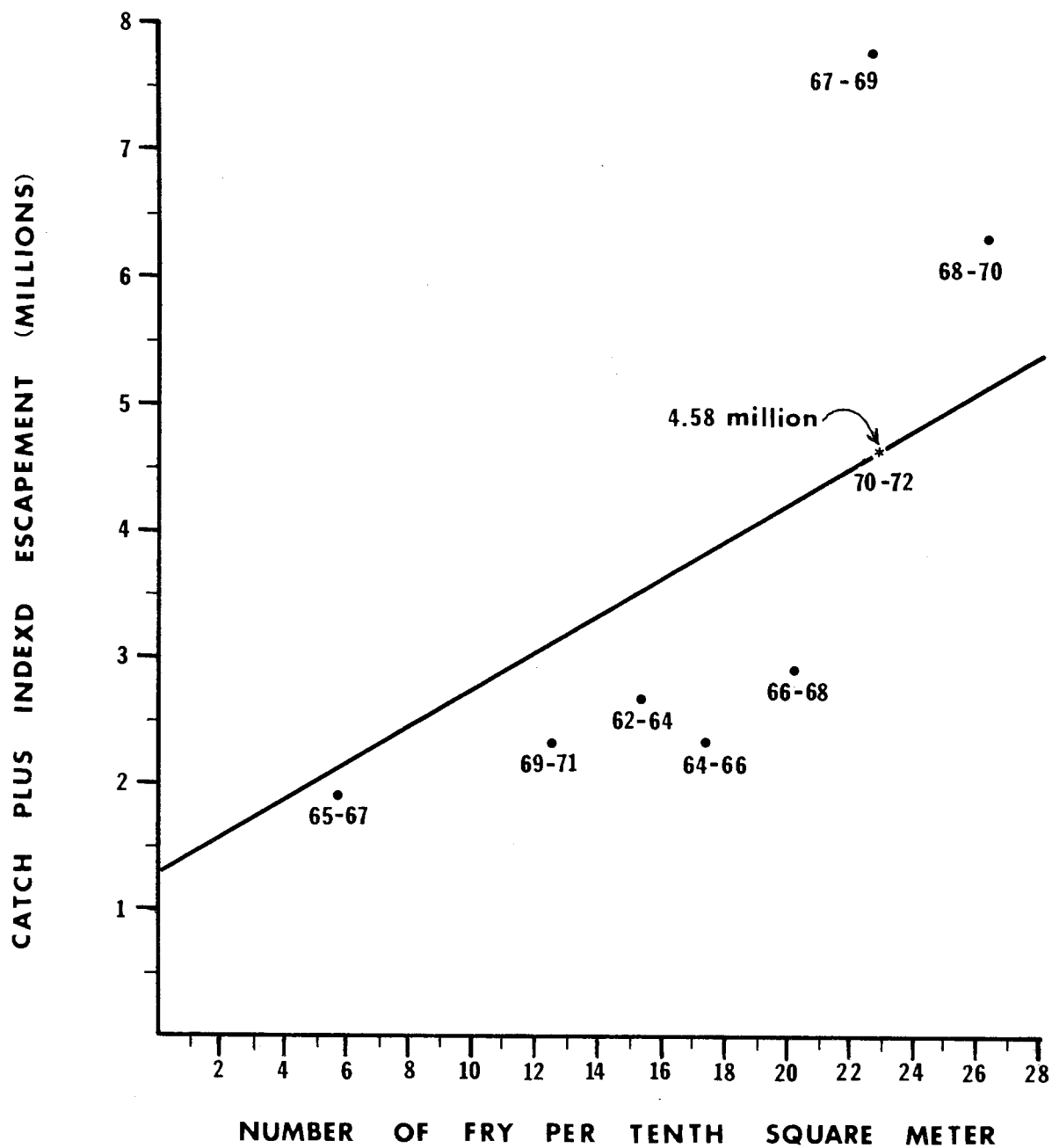


FIGURE 3.--RELATIONSHIP BETWEEN PARENT YEAR FRY DENSITIES 1962-1970 AND SUBSEQUENT ADULT RETURNS 1964-1972, FOR THE GENERAL DISTRICT IN THE KODIAK AREA. THE 1963 FRY DENSITY DATA FOR THE 1965 ADULT RETURN IS NOT AVAILABLE.

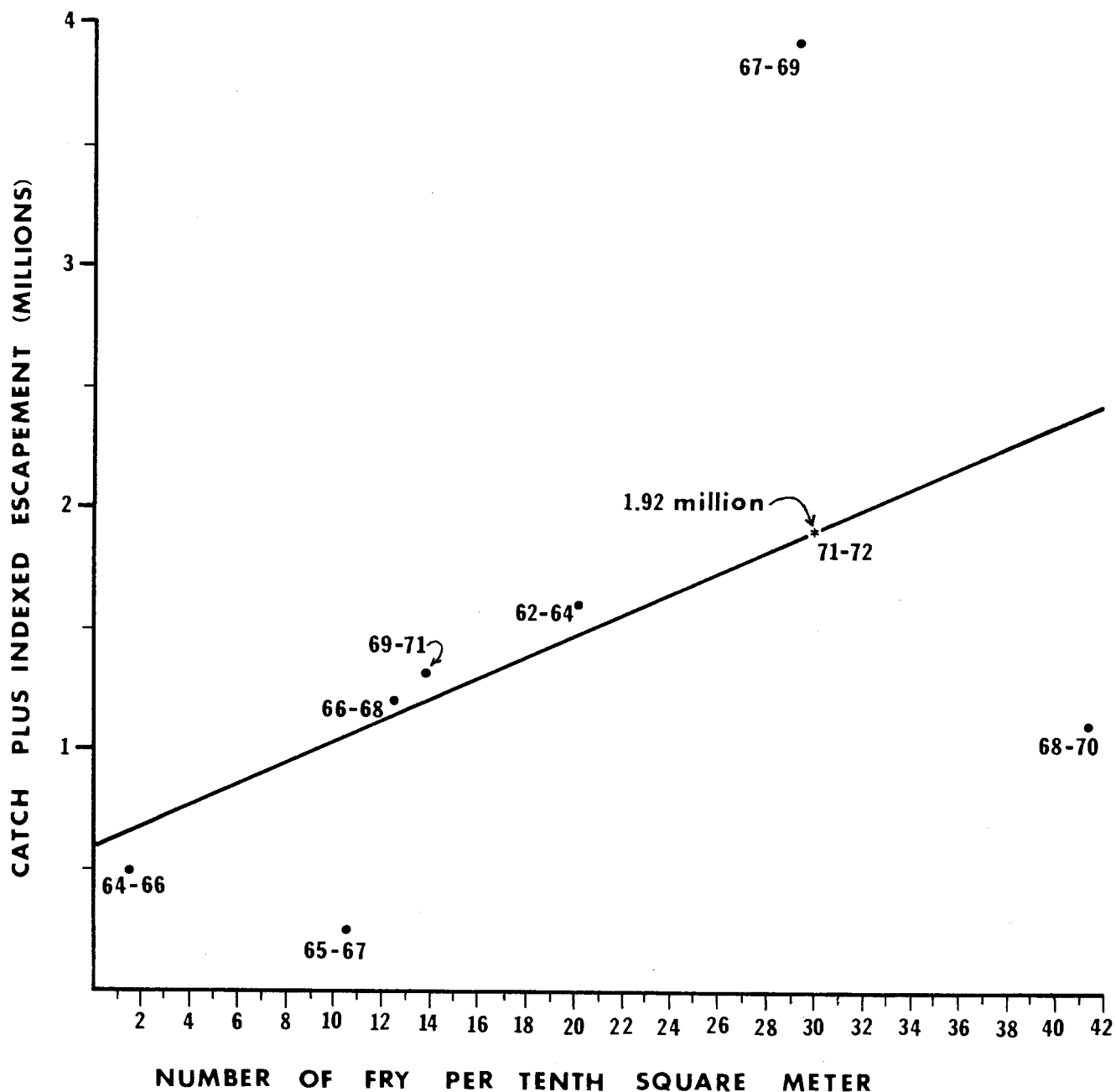


FIGURE 4.--RELATIONSHIP BETWEEN PARENT YEAR FRY DENSITIES 1962-1970 AND SUBSEQUENT ADULT RETURNS 1964-1972, TO THE ALITAK DISTRICT. THE 1963 FRY DENSITY DATA FOR THE 1965 ADULT RETURN IS NOT AVAILABLE.

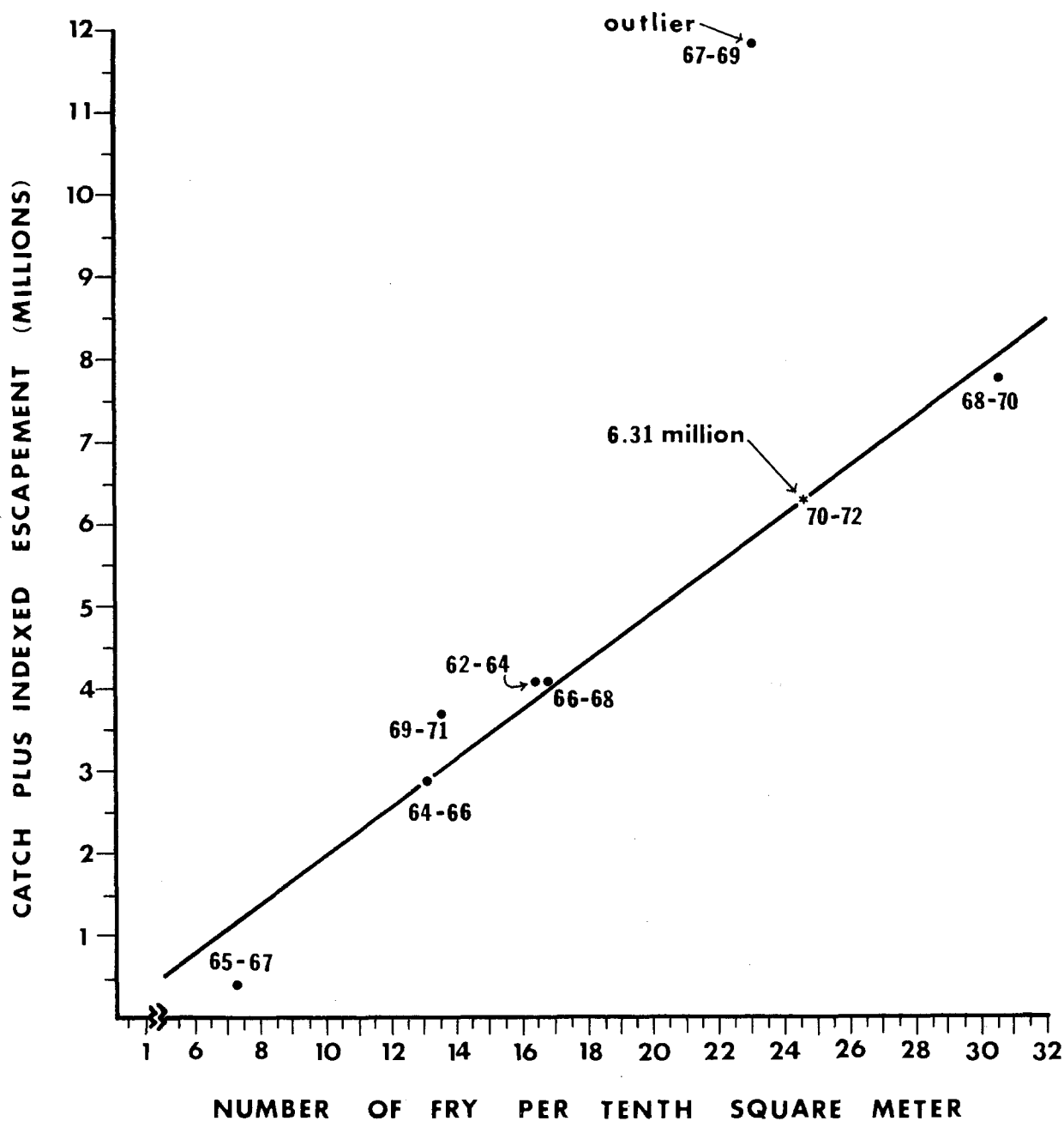


FIGURE 5.--RELATIONSHIP BETWEEN PARENT YEAR FRY DENSITIES 1962-1970 AND SUBSEQUENT ADULT RETURNS 1964-1972, FOR THE ALITAK AND GENERAL DISTRICTS IN THE KODIAK AREA. THE 1963 FRY DENSITY DATA FOR THE 1965 ADULT RETURN IS NOT AVAILABLE.

The Alitak district return of 1.92 million added to the General district return of 4.58 million equals a total of 6.50 million pink salmon. This figure is very near the estimated return of 6.31 million pink salmon derived from combining data from both districts.

The generally poor densities obtained from the Afognak district indicate a return of about .53 million. This does not compare well with the 1970 parent year return of 1.7 million. The forecast estimate of .53 million was developed from the equation  $Y = .0891X - .4093$  (Figure 6). The linear correlation coefficient for this regression estimate is .69.

The westside of Kodiak Island is comprised of the Uganik, Uyak, Karluk, Sturgeon, and Red River districts. The pre-emergent fry densities obtained in these districts were nearly all below the 1970 (parent year) densities. Unlike pre-emergent fry data obtained from the other districts, the fry data from the Westside districts does not yield satisfactory results when subjected to linear regressions. Very poor correlation coefficients may indicate that the areas sampled in the streams on the Westside are not the best indicators on some years or perhaps these sampling areas need to be enlarged before a satisfactory correlation between fry densities and adult returns can be achieved.

The summation of the Afognak, General and Alitak district forecasts (7.03 million) leaves approximately 2.5 million pink salmon unaccounted for, assuming the total Kodiak Area (excluding the Mainland district) forecast of 9.5 million pink salmon is correct. A forecast of 2.5 million to the Westside districts would seem to be quite low when compared to past even-year returns, but not unreasonable considering the relatively poor Westside fry densities associated with the 1972 return. Uyak River, Karluk River, and Red River should be the primary producers for the Westside.

#### Anticipated Commercial Harvest

An estimated escapement index of 3.0 million pink salmon is desired for the major pink salmon producing streams on the even-year cycle for the Kodiak Area (excluding the Mainland district). Assuming that the 1972 pink salmon return is near the 9.5 million forecast, approximately 6.5 million pink salmon may be available for commercial harvest. A harvest of 6.5 million is well below the average even-year harvest of 10.7 million for the period 1960-1970.

The primary objective of pink salmon management is to achieve optimum or desired spawning populations. Therefore, if the 1972 pink salmon return is smaller than forecast, stricter harvest regulations may be necessary to insure the desired escapement goal. By the same reasoning, a pink salmon return larger than forecast would allow relaxation of commercial fishing regulations, resulting in a larger commercial harvest.

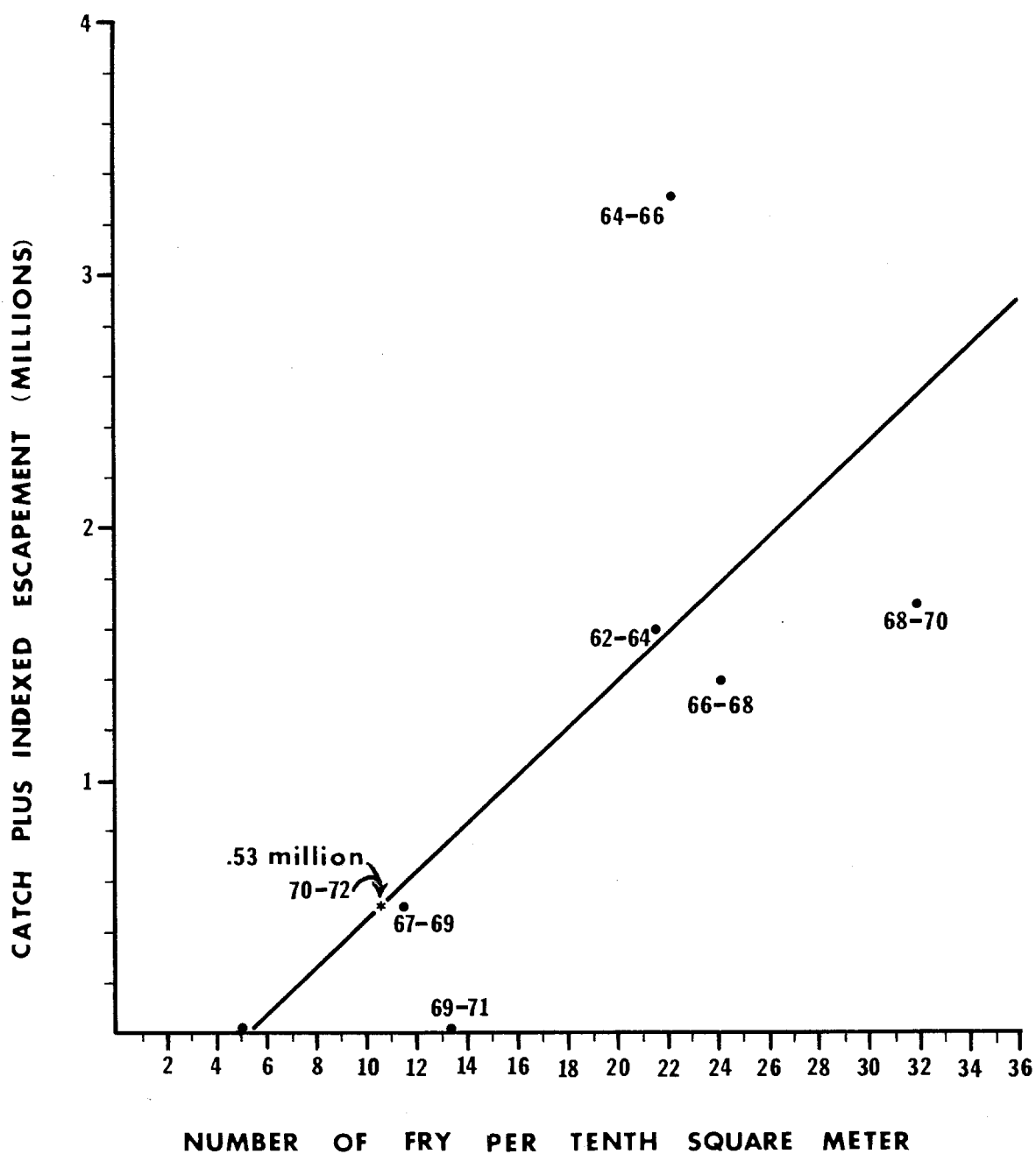


FIGURE 6.--RELATIONSHIP BETWEEN PARENT YEAR FRY DENSITIES 1962-1970 AND SUBSEQUENT ADULT RETURNS 1964-1972, FOR THE AFOGNAK DISTRICT IN THE KODIAK AREA. THE 1963 FRY DENSITY DATA FOR THE 1965 ADULT RETURN IS NOT AVAILABLE.

### Mainland District

The Mainland district of the Kodiak Area includes all Alaska Peninsula waters from Cape Douglas to Kilokak Rocks. Pre-emergent fry sampling is not conducted in this area and because of incomplete escapement data, no escapement-return relationship has been developed. Therefore, no formal forecast will be presented for the Mainland district. The commercial catches from 1962-1971 have been presented in this report (Table 3). The inconstant nature of the commercial catches for the Mainland district is due in part to the variability of the fishing effort in that area which precludes any projection of commercial harvest.

Table 3. Commercial pink salmon catch for Mainland district, Kodiak Area, 1962-1971.

Even Year	Commercial Catch <sup>1</sup>	Odd Year	Commercial Catch <sup>1</sup>
1962	1,188,000	1963	5,000
1964	605,000	1965	65,000
1966	301,000	1967	1,000
1968	378,000	1969	66,000
1970	284,000	1971	384,000 <sup>2</sup>
Average	551,000		104,000

<sup>1</sup> From Kodiak Area Management Reports.

<sup>2</sup> Preliminary.

## SUMMARY

Data derived from pre-emergent fry densities and the subsequent adult returns form the basis for this forecast.

Pre-emergent fry sampling is accomplished in the spring (March and April), after the major freshwater mortality factors have diminished and is currently the best method of indexing the abundance of pink salmon.

Thirty-one streams containing 75 per cent of the estimated total 1970 escapement in the Kodiak Area (excluding the Mainland district) were chosen as index streams for pre-emergent sampling in the spring of 1971.

Using all available years of pre-emergent fry index-adult return data, an estimated return of 9.5 million pink salmon to the Kodiak Area (excluding the Mainland district) was developed from a linear regression analysis. Confidence limits of 80 per cent produce a range for the 1972 forecast of 7.9 - 11.1 million pink salmon.

Certain fishing districts in the Kodiak Area showed a satisfactory correlation to linear regressions made on pre-emergent fry index-adult return data.

The Afognak district is expected to receive a return of about 0.5 million pink salmon. An estimated 4.6 million pink salmon should return to the General district. The Alitak district is expected to receive an estimated 1.9 million pink salmon. The districts on the westside of Kodiak Island do not show a satisfactory correlation to linear regressions made on pre-emergent fry index-adult return data.

The summation of the Afognak, General and Alitak district forecasts (7.0 million) leaves approximately 2.5 million pink salmon unaccounted for, assuming the total Kodiak Area (excluding the Mainland district) forecast of 9.5 million pink salmon is correct. A forecast of 2.5 million to the Westside districts would seem to be quite low when compared to past even-year returns, but not unreasonable considering the relatively poor Westside fry densities associated with the 1972 return.

No formal forecast is presented for the Mainland district. However, the commercial catches from 1962 to 1971 are presented.

An estimated escapement index of 3.0 million pink salmon is desired for the major pink salmon producing streams on the even-year cycle for the Kodiak Area (excluding the Mainland district). Assuming that the 1972 pink salmon return is near the 9.5 million forecast, approximately 6.5 million pink salmon may be available for commercial harvest.

#### LITERATURE CITED

Alaska Department of Fish and Game, Kodiak Area Annual Mgmt. Reports,  
Manuscript Reports 1962-1970.

APPENDIX A. KODIAK AREA PINK SALMON RETURNS, 1962-1971.

District	INDEXED ESCAPEMENT (37 STREAMS)				
	1962	1963	1964	1965	1966
Afognak	320,300	22,400	184,000	26,300	159,300
Uganik and Uyak	393,000	209,200	362,000	94,100	291,000
Karluk, Sturgeon and Red River	1,485,800	0	1,090,000	0	490,000
Alitak	441,000	214,700	162,800	250,700	76,700
General (Eastside)	660,900	128,800	286,000	135,700	186,400
Total	3,301,000	575,100	2,084,800	506,800	1,203,400

	CATCH				
	1962	1963	1964	1965	1966
Afognak	2,281,000	648,000	1,402,000	138,000	3,200,000
Uganik and Uyak	1,676,000	873,000	2,526,000	643,000	3,705,000
Karluk, Sturgeon and Red River	3,990,000	21,000	3,693,000	19,000	777,000
Alitak	1,887,000	1,527,000	1,419,000	1,136,000	433,000
General (Eastside)	3,154,000	2,413,000	2,217,000	887,000	2,162,000
Total	12,988,000	5,482,000	11,257,000	2,823,000	10,277,000

	TOTAL RETURN - CATCH AND ESCAPEMENT INDEX				
	1962	1963	1964	1965	1966
Afognak	2,601,300	670,400	1,586,000	164,300	3,359,300
Uganik and Uyak	2,069,000	1,082,200	2,888,000	737,100	3,996,000
Karluk, Sturgeon and Red River	5,475,800	21,000	4,783,000	19,000	1,267,000
Alitak	2,328,000	1,741,700	1,581,800	1,386,700	509,700
General (Eastside)	3,814,900	2,541,800	2,503,000	1,022,700	2,348,400
Total	16,289,000	6,057,100	13,341,800	3,329,800	11,480,400

APPENDIX A. (CONTINUED) KODIAK AREA PINK SALMON RETURNS, 1962-1971.

District	INDEXED ESCAPEMENT (37 STREAMS)				
	1967	1968	1969	1970	1971
Afognak	34,700	99,000	84,500	272,000	58,500
Uganik and Uyak	157,200	202,000	236,600	338,000	162,400
Karluk, Sturgeon and Red River	0	470,000	0	1,058,000	4,000
Alitak	154,100	168,700	178,700	218,500	291,800
General (Eastside)	147,300	283,500	284,700	484,750	213,100
Total	493,300	1,223,200	784,500	2,371,250	729,800

	CATCH				
	1967	1968	1969	1970	1971 <sup>1/</sup>
Afognak	28,000	1,315,000	413,000	1,453,000	1,000
Uganik and Uyak	22,000	1,951,000	608,000	1,978,000	780,000
Karluk, Sturgeon and Red River	6,000	1,495,000	30,000	1,245,000	0
Alitak	85,000	1,046,000	3,754,000	950,000	1,072,000
General (Eastside)	45,000	2,583,000	7,615,000	6,110,000	2,135,000
Total	186,000	8,390,000	12,420,000	11,736,000	3,988,000

	TOTAL RETURN - CATCH AND ESCAPEMENT INDEX				
	1967	1968	1969	1970	1971
Afognak	62,700	1,414,000	497,500	1,725,000	59,500
Uganik and Uyak	179,200	2,153,000	844,600	2,316,000	942,400
Karluk, Sturgeon and Red River	6,000	1,965,000	30,000	2,303,000	4,000
Alitak	239,100	1,214,700	3,932,700	1,168,500	1,363,800
General (Eastside)	192,300	2,866,500	7,899,700	6,594,750	2,348,100
Total	679,300	9,613,200	13,204,500	14,107,250	4,717,800

<sup>1/</sup> All 1971 catch figures are preliminary

APPENDIX B. KODIAK AREA INDEXED ESCAPEMENT (37 STREAMS), 1962-1971.

Index streams	1962	1963	1964	1965	1966
Portage Lake**	27,300	3,200	37,000	10,000	20,000
Paramanof-304**	20,000	700	18,000	2,200	17,000
Malina**	60,000	0	35,000	200	19,000
Afognak**	75,000	2,000	45,000	900	26,000
Marka**	65,000	4,000	22,000	3,500	35,000
Danger**	50,000	2,500	11,000	2,000	25,000
Elbow**	15,000	5,000	11,000	3,200	13,000
Kizhuyak-365	8,000	5,000	5,000	4,300	4,300
Bauman's**	17,000	--	8,000	1,800	9,000
Terror**	45,000	35,000	40,000	12,000	85,000
Uganik**	100,000	45,000	75,000	12,000	80,000
Little**	45,000	--	50,000	--	37,000
Zachar**	25,000	89,000	24,000	8,000	16,000
Brown's**	96,000	200	65,000	300	24,000
Uyak**	65,000	40,000	100,000	60,000	40,000
Karluk**	350,000	--	525,000	--	225,000
Sturgeon**	35,800	--	140,000	--	90,000
Red**	1,100,000	--	425,000	--	175,000
Dog Salmon**	83,000	60,000	50,000	36,000	21,000
Narrows**	18,000	1,700	4,200	2,500	600
Horse Marine	3,000	0	2,600	--	800
Deadman**	25,000	22,000	18,000	30,000	12,000
Sulua	12,000	16,000	8,000	7,000	6,000
Old Tom's	0	--	--	200	300
Humpy**	300,000	115,000	80,000	175,000	36,000
Seven**	128,000	40,000	10,000	60,000	16,000
Kaiugnak**	34,000	7,000	10,000	8,500	10,000
Barling**	40,000	8,000	60,000	3,500	20,000
Midway	6,000	5,000	--	1,000	4,500
Shearwater	500	50	--	50	900
Kiliuda-207**	18,700	5,000	17,000	1,100	9,000
Eagle Harbor	26,700	600	13,000	1,000	8,000
Saltery**	70,000	35,000	28,000	20,000	17,000
Miam**	37,000	--	--	--	22,000
Sid Old's**	70,000	10,000	30,000	6,000	35,000
American**	21,000	11,000	25,000	9,000	24,000
Buskin**	209,000*	7,200*	93,000*	25,600*	20,000*
	3,301,000	575,150	2,084,800	506,850	1,203,400

\* ADF&G count, all others FRI

\*\* Denotes even-year pre-emergent fry sampling stream

APPENDIX B. (CONTINUED) KODIAK AREA INDEXED ESCAPEMENT (37 STREAMS), 1962-1971.

Index streams	1967	1968	1969	1970	1971
Portage Lake**	3,000	6,000	25,000*	15,000*	25,000*
Paramanof-304**	200	27,000	2,900*	15,000*	1,300*
Malina**	--	13,000	1,000*	31,000*	100*
Afognak**	1,000	10,000	12,000*	25,000*	3,400*
Marka**	2,500	15,000	12,000*	120,000*	12,500*
Danger**	5,000	15,000	7,600*	45,000*	5,800*
Elbow**	11,000	11,000	9,000	10,000*	6,400
Kizhuyak-365	12,000	2,000	15,000	11,000*	4,000
Bauman's**	4,200	6,000	7,000	7,000*	6,000*
Terror**	35,000	45,000	55,000	40,000*	40,000*
Uganik**	40,000	21,000	60,000	80,000*	37,000*
Little**	--	45,000	--	75,000*	--
Zachar**	2,700	15,000	17,000	30,000*	14,000
Brown's**	300	35,000	2,600*	37,000*	400*
Uyak**	75,000	35,000	95,000	69,000*	65,000
Karluk**	--	140,000	--	210,000*	--
Sturgeon**	--	30,000	--	48,000*	4,000*
Red**	--	300,000	--	800,000*	--
Dog Salmon**	11,000	12,000	45,000	25,000*	63,000*
Narrows**	3,500	2,800	6,000*	3,000*	5,000
Horse Marine	300	2,400	--	500*	400
Deadman**	70,000	20,000	65,000	65,000*	100,000
Sulua	7,000	6,000	4,500	5,000*	1,000
Old Tom's	2,300	5,500	3,200	10,000*	400
Humpy**	60,000	120,000	55,000	110,000*	122,000*
Seven**	25,000	55,000	33,000	100,000*	54,000*
Kaiugnak**	8,000	10,000	4,000	29,000*	3,000*
Barling**	12,000	28,000	20,000	48,000*	23,000*
Midway	100	6,000	1,900*	14,000*	1,900*
Shearwater	500	500	60	3,500*	100
Kiliuda-207**	1,700	5,000	2,000	8,000*	2,500
Eagle Harbor	3,000	10,000	1,200	19,000*	1,800
Saltery**	36,000	5,000	50,000	15,000*	57,000*
Miam**	--	42,000	--	57,000*	3,000*
Sid Old's**	19,000	55,000	36,000	63,000*	40,000*
American**	14,000	25,000	70,000	84,000*	18,900*
Buskin**	28,000*	42,000*	66,500*	44,250*	7,900*
	493,300	1,223,200	784,460	2,371,250	729,800

\* ADF&G count, all others FRI

\*\* Denotes even-year pre-emergent fry sampling stream

APPENDIX C. GENERAL CONDITIONS OBSERVED IN THE 1971 KODIAK AREA PINK SALMON PRE-EMERGENT FRY SAMPLING STREAMS.

Stream	Remarks
Portage Lake (upstream)	Sampled April 12th while the water temperature was 34° F. Many of the fry were completely buttoned up, but no out-migration was observed. The water level was relatively low.
Portage Lake (downstream)	Sampled April 28th while the water temperature was 35° F. A few fry were nearly buttoned up but no out-migration was observed. Stream flow was relatively low but the stream must be sampled during low tide.
Paramanof - 304	Sampled April 28th while the water temperature was 36° F. Because of high water and ice conditions, the intertidal zone could not be checked accurately for out-migrants. Judging from the development of the fry (fry were found in all stages of development), apparently out-migration had not yet commenced. There was some selectivity towards shallow water sampling sites due to the deep white water that persisted through much of the center of the stream.
Malina	Unsampleable in March and April due to ice conditions and later because of constant high water. Much of the river remained frozen through the first part of May.
Afognak (upstream)	Sampled on April 6th while the water temperature was 34° F. The fry were well advanced (many were buttoned up) but no out-migration was observed in the river or in the intertidal zone. An average of 3'-4' of snow and relatively high water made sampling difficult.
Marka	Unsampleable because of severe ice conditions and constant high water that extended into May.
Danger	Sampled on April 28th and no stream temperature was recorded. High water, anchor ice and surface ice along the edges of the stream made sampling difficult. Approximately 20% of the fry appeared to be buttoned up, but the majority had fair-sized yolk sacs. No out-migration was observed.

APPENDIX C. (CONTINUED) GENERAL CONDITIONS OBSERVED IN THE 1971 KODIAK  
AREA PINK SALMON PRE-EMERGENT FRY SAMPLING STREAMS.

Stream	Remarks
Elbow (Sheratin)	Sampled February 24th and March 20th while the water temperature was 34° F. Those fry found in February exhibited large yolk sacs and those sampled in March were very nearly buttoned up. No out-migration was observed.
Bauman's	Sampled on March 20, 1971. The ice was an average of one inch thick over a small portion of the upper sampling area. Most of the fry exhibited very large yolk sacs. The water level was near normal, but the stream banks showed evidence of recent high water and extensive scouring by ice. The water temperature was 33° F.
Terror	Sampled on March 30th while the water temperature was 37° F. Most of the fry were 50% to 75% buttoned up, with those found in the intertidal zone being the farthest advanced. Two chum fry were observed as out-migrants in an intertidal pool, but no pink salmon out-migrants were observed.
Uganik	Sampled on March 30th, while the water temperature was 36° F. Stream flow was near normal and no out-migration was observed.
Little	Sampled on March 31st, while the water temperature was 34° F. The water level in the stream was relatively low and the banks of the river were about 3' deep in snow and ice. Several snow bridges in the sampling area made walking difficult.
Zachar	Sampled March 31st while the water temperature was 37° F. The water level was near normal and no out-migration was observed.
Brown's	Sampled April 29th while the water temperature was 36° F. Sampling was done late in the season because of severe ice conditions and apparently out-migration was well underway by this date. Therefore, the density obtained is not reliable and will not be used for forecast purposes.

APPENDIX C. (CONTINUED) GENERAL CONDITIONS OBSERVED IN THE 1971 KODIAK  
AREA PINK SALMON PRE-EMERGENT FRY SAMPLING STREAMS.

Stream	Remarks
Uyak	Sampled March 22nd while the water temperature was 39° F. Water level was normal and there was no evidence of severe scouring, although deep snow and ice were prevalent on the stream banks. No out-migrants were observed.
Karluk	Sampled April 1st while the water temperature was 32° F. Severe ice conditions and high water hampered sampling efforts and only 70% of the usual sampling area was covered. The fry exhibited large yolk sacs and were fairly uniformly distributed over the sampling area so the density should be reliable.
Sturgeon	Sampled April 9th while the water temperature was 33° F. The water level was near normal, but there was evidence of extensive scouring and lots of loose silty gravel.
Red	Sampled April 10th while the water temperature was 38° F. The entire stream was frozen over about 50 yards below the lower end of the sampling area. Floating ice made sampling difficult by plugging nets and the pump intake filter. No out-migration was observed.
Dog Salmon (downstream)	Sampled March 26th while the water temperature was 34° F. All the fry observed had fair-sized yolk sacs and there was no evidence of out-migration. Extremely severe scouring had been in progress. Cottonwood trees on the banks were damaged from ice 4' to 8' high. Tremendous "ice wedges" were piled up to 6' high on the banks. Large chunks of ice were found more than 100 yards from the stream bed.
Narrows	Sampled April 10th while the water temperature was 34° F. The water level was about normal and no out-migration was observed.
Deadman	Sampled March 21st while the water temperature was 36° F. The water level was near normal and there was no evidence of either out-migration or severe flooding and ice conditions.

APPENDIX C. (CONTINUED) GENERAL CONDITIONS OBSERVED IN THE 1971 KODIAK  
AREA PINK SALMON PRE-EMERGENT FRY SAMPLING STREAMS.

Stream	Remarks
Humpy (upstream)	This portion of the stream was not sampled because of solid ice conditions that persisted through the first half of May. Solid ice was measured a few inches into the gravel in some sections of the stream.
Humpy (downstream)	Sampled April 29th while the water temperature was 33° F. None of the fry were close to being buttoned up. Evidence of severe scouring was noted and several ice bridges were still intact in the sampling area.
Seven Rivers (upper fork)	Sampled April 29th while the water temperature was 35° F. Fry in various stages of development were observed scattered on top of the snow along both banks of the stream, apparently they were forced out of the gravel during recent scouring and flooding conditions. No out-migrants were observed in the stream and very few of the fry taken were in the buttoned-up stage.
Seven Rivers (lower fork)	Sampled April 10th while the water temperature was 35° F. Much less evidence of scouring or flooding conditions was noted in this fork of the stream. The water level was normal and no out-migrants were observed.
Kaiugnak	Sampled May 9th while the water temperature was 37° F. The water level was about normal but sampling was hampered because of extensive surface ice that extended out from the banks of the stream. No evidence of out-migration was noted.
Barling	Sampled March 20th while the water temperature was 39° F. No evidence of severe scouring or out-migration was observed.
Kiliuda - 207	Sampled on March 20th while the water temperature was 37° F. There was some evidence of ice scouring but no evidence of out-migration. The water level was about normal.
Saltery	Sampled February 27th while the water temperature was 36° F. Sampling was hampered by high water and ice conditions in the stream. Severe scouring of the stream-bed gravel was in progress.

APPENDIX C. (CONTINUED) GENERAL CONDITIONS OBSERVED IN THE 1971 KODIAK  
AREA PINK SALMON PRE-EMERGENT FRY SAMPLING STREAMS.

Stream	Remarks
Hurst	Sampled April 1st while the water temperature was 37° F. The water level was about normal and there was some evidence of scouring. No out-migrants were observed.
Miam	Sampled February 26th while the water temperature was 33° F. Many of the fry were nearly ready to migrate. The water level was about normal and no out-migrants were observed. Some light surface ice was encountered in the sampling area.
Sid Old's	Sampled February 23rd while the water temperature was 34° F. The upper end of the sampling area showed signs of severe scouring and high water. The water level was about normal and no evidence of out-migration was observed.
American	Sampled on February 19th while the water temperature was 35° F. The water level was about normal and no signs of out-migration were observed.
Buskin	Sampled February 17th and 18th while the water temperature was 34° F. The water level was a little high, but there was no evidence of severe flooding or scouring. The fry were not well developed so it is safe to assume that out-migration had not begun.

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